The OMI NO_2 Standard Product

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Overview

- OMI instrument
- OMI NO_2 Standard Product
- Quality of NO_2 data
- Cautions about data comparisons
- Challenges and work in progress

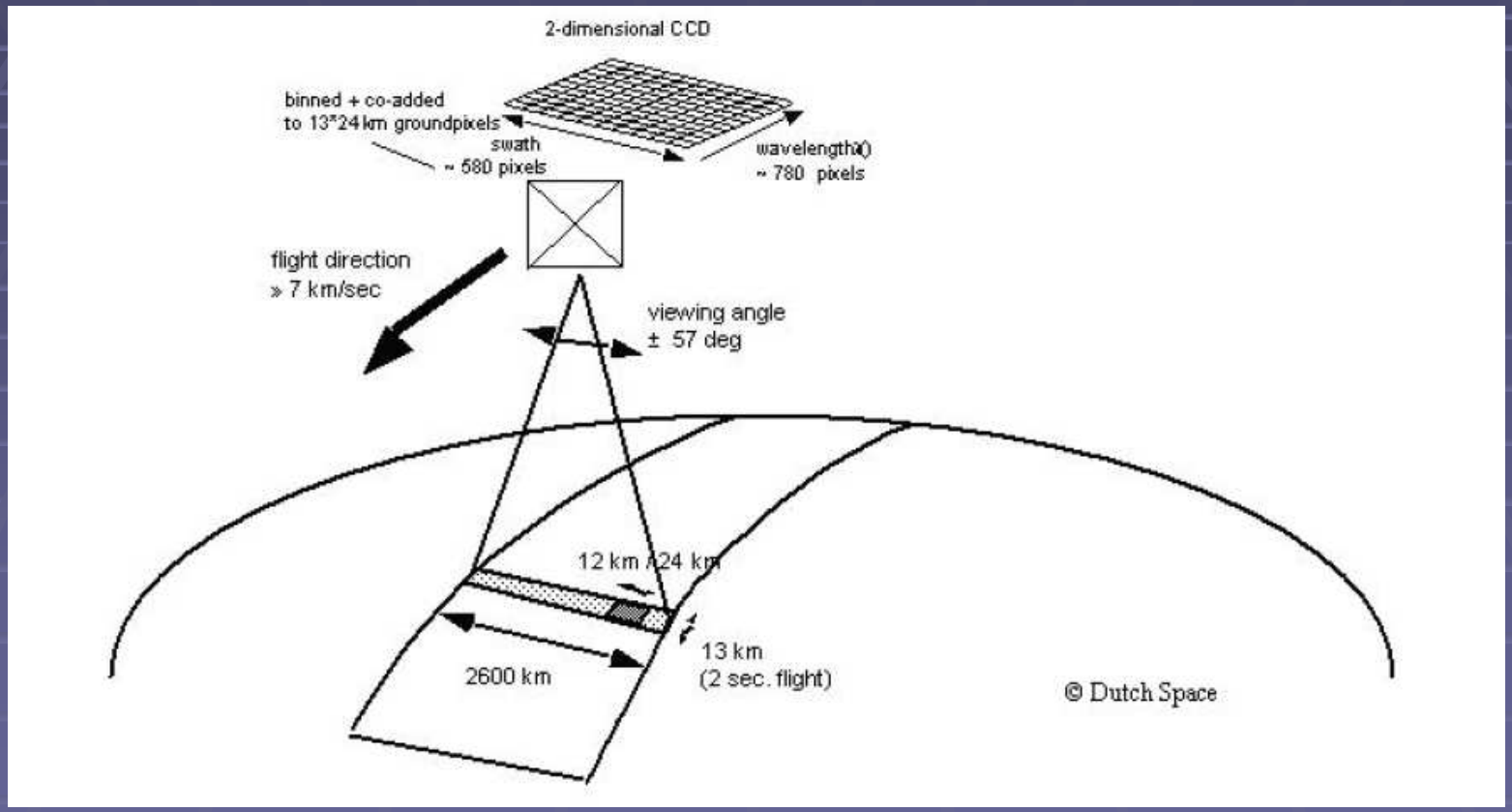
OMI

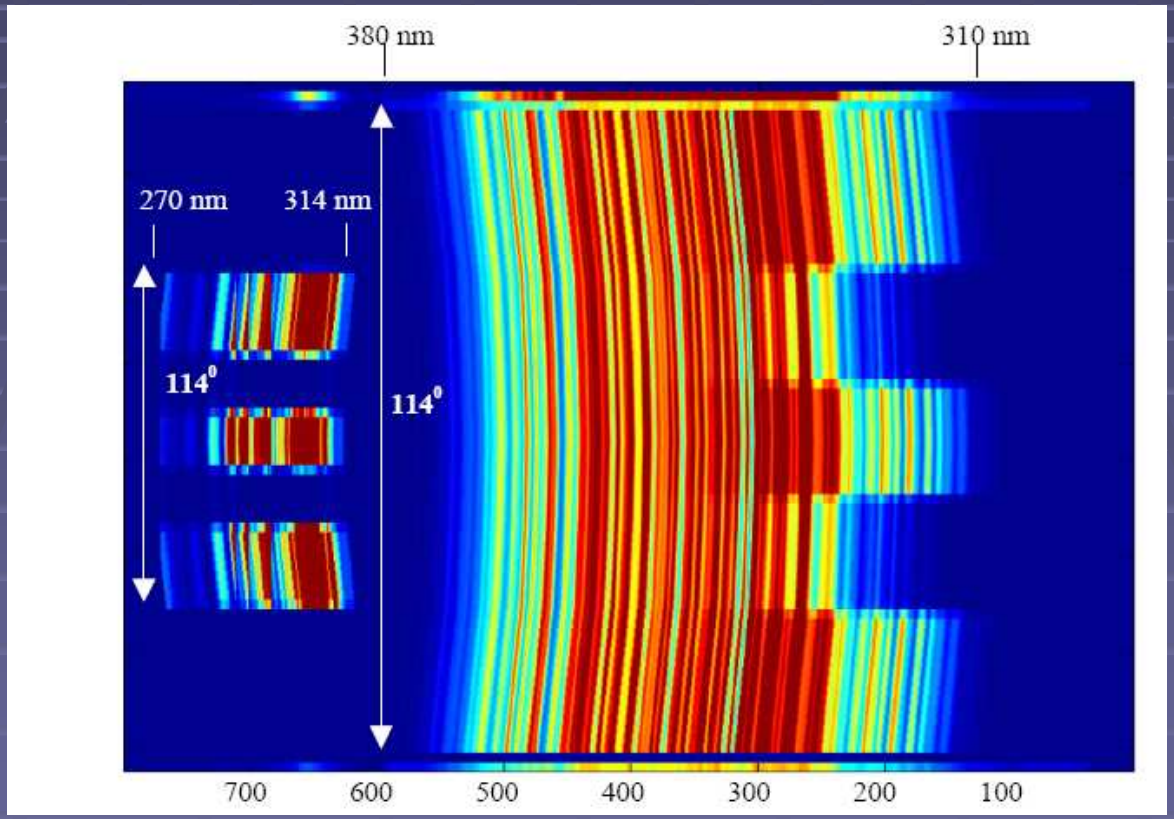
- **Ozone Monitoring Instrument**
- Joint Netherlands, Finland, US project
- **EOS Aura Satellite**
- **A-Train**
- Launch: 15 July 2004
- Nominal ops: 06 Sept 2004

- Polar, sun-synchronous orbit
- Overpass time at equator (AN): 13h45
- Swath width sufficient to give global coverage (swaths touch at equator)

OMI Instrument (cont'd)

- 2D CCD detector
  - Simultaneous cross-track spatial and spectral coverage
  - Coverage in 3 spectral ranges
    - UV1 (270-314 nm); UV2 (306-380 nm); VIS (350-500 nm)
  - Retrievals
    - Ozone
    - NO_2
    - SO_2
    - ClO, OClO, HCHO, BrO, OHCCHO (glyoxal)
    - Cloud heights and cloud fraction
    - Aerosol OD and SSA.


2-dimensional CCD
binned + co-added
to 13*24 km groundpixels
swath
~ 580 pixels
wavelength()
~ 780 pixels
flight direction
» 7 km/sec
viewing angle
± 57 deg
12 km / 24 km
13 km
(2 sec. flight)
2600 km
© Dutch Space


380 nm
310 nm
270 nm
314 nm
114⁰
114⁰
700
600
500
400
300
200
100
⟵ Wavelength ⟶
⟵ Cross-track pos. ⟶

OMI NO_2 Standard Product Algorithm

Proceeds in 3 steps

1. Fit laboratory spectra to spectral albedo to obtain slant column density.
2. Compute air mass factors (AMF) to apply, according to the geophysical situation
3. Stratosphere/Troposphere separation and correction of polluted FoVs.

Absorption cross sections for common atmospheric species (400-465 nm)

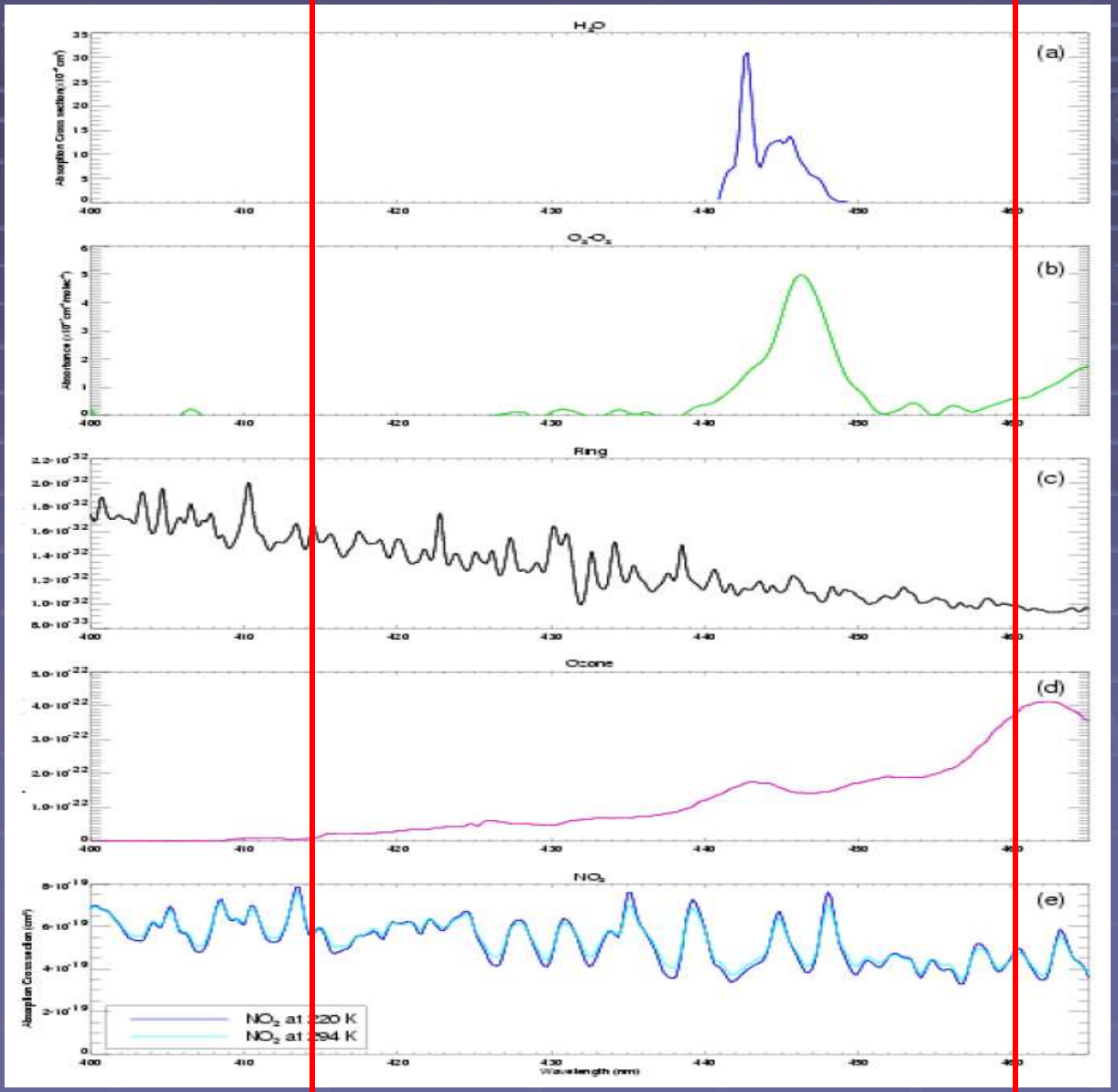
H_2O

O_2-O_2

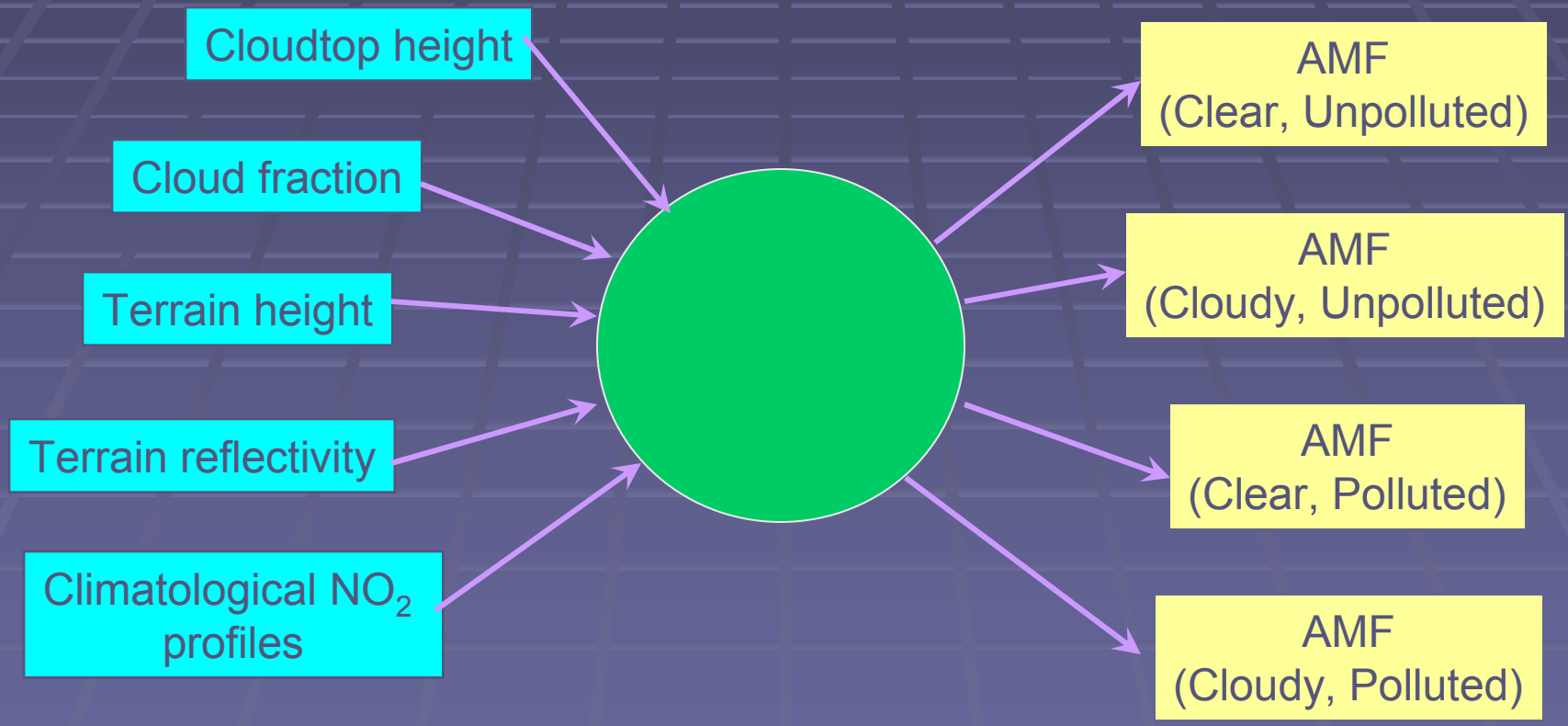
Ring Effect

O_3

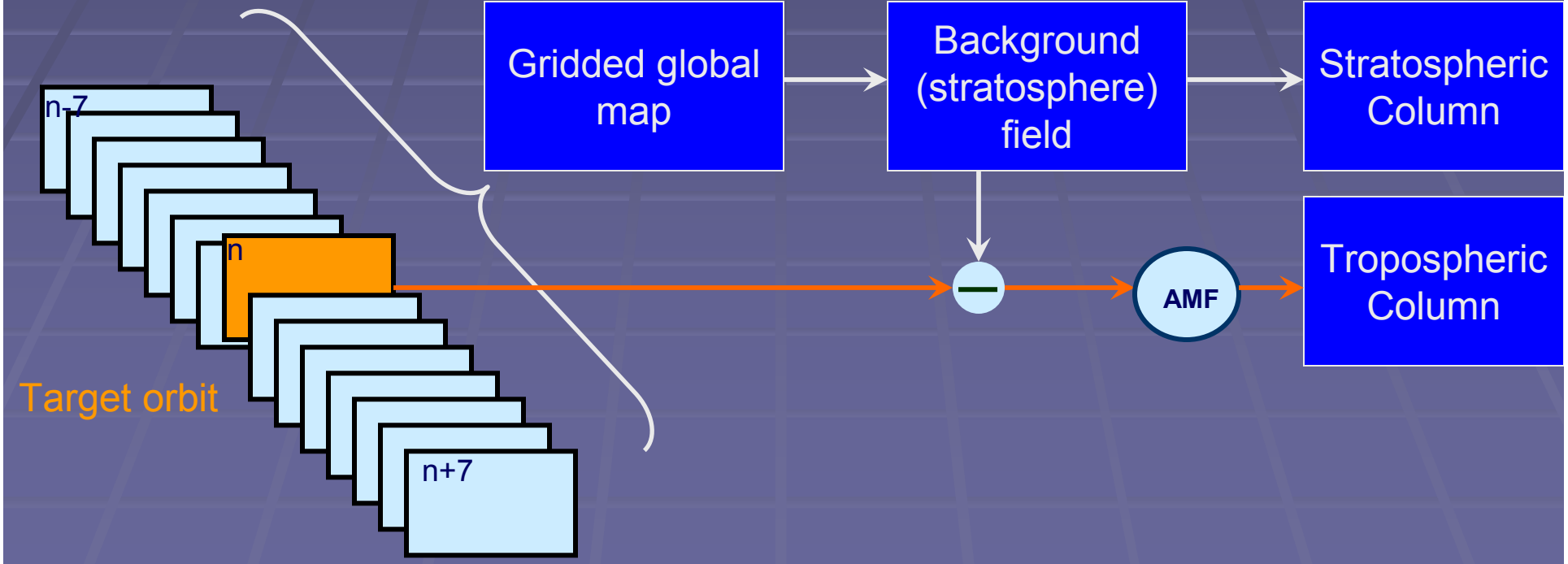
NO_2



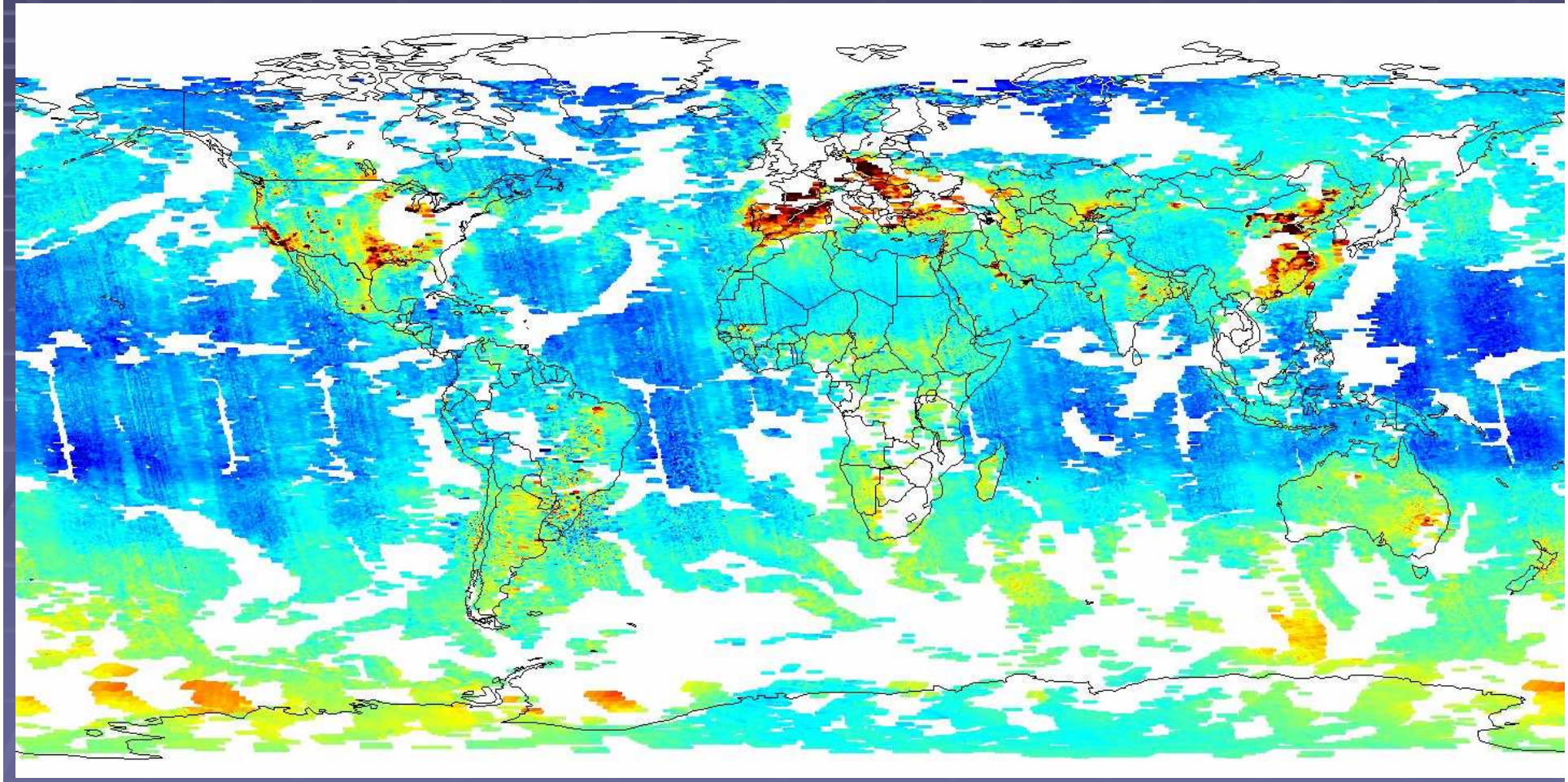
Computation of Air Mass Factors (AMFs)



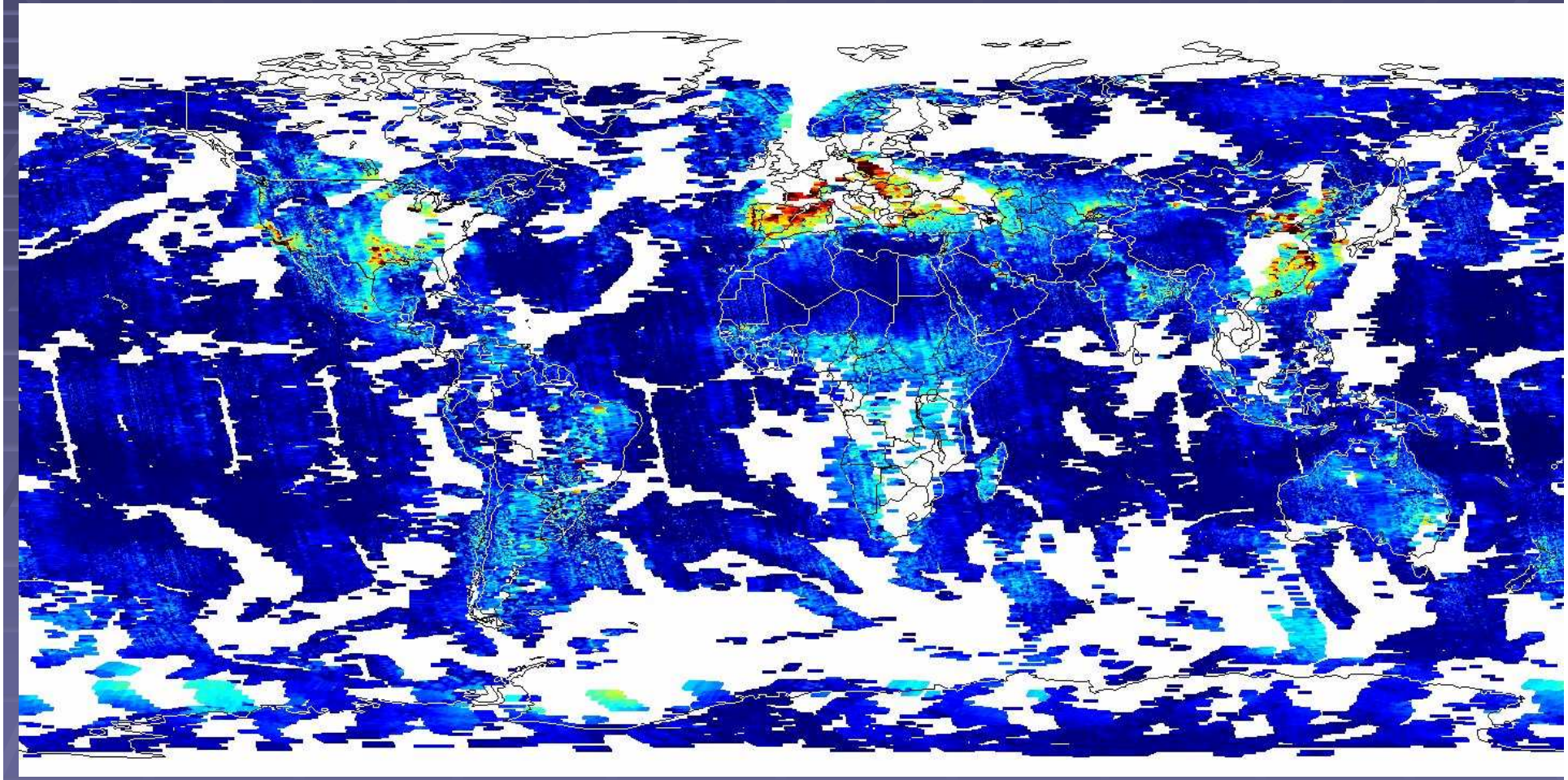
Stratosphere-Troposphere Separation



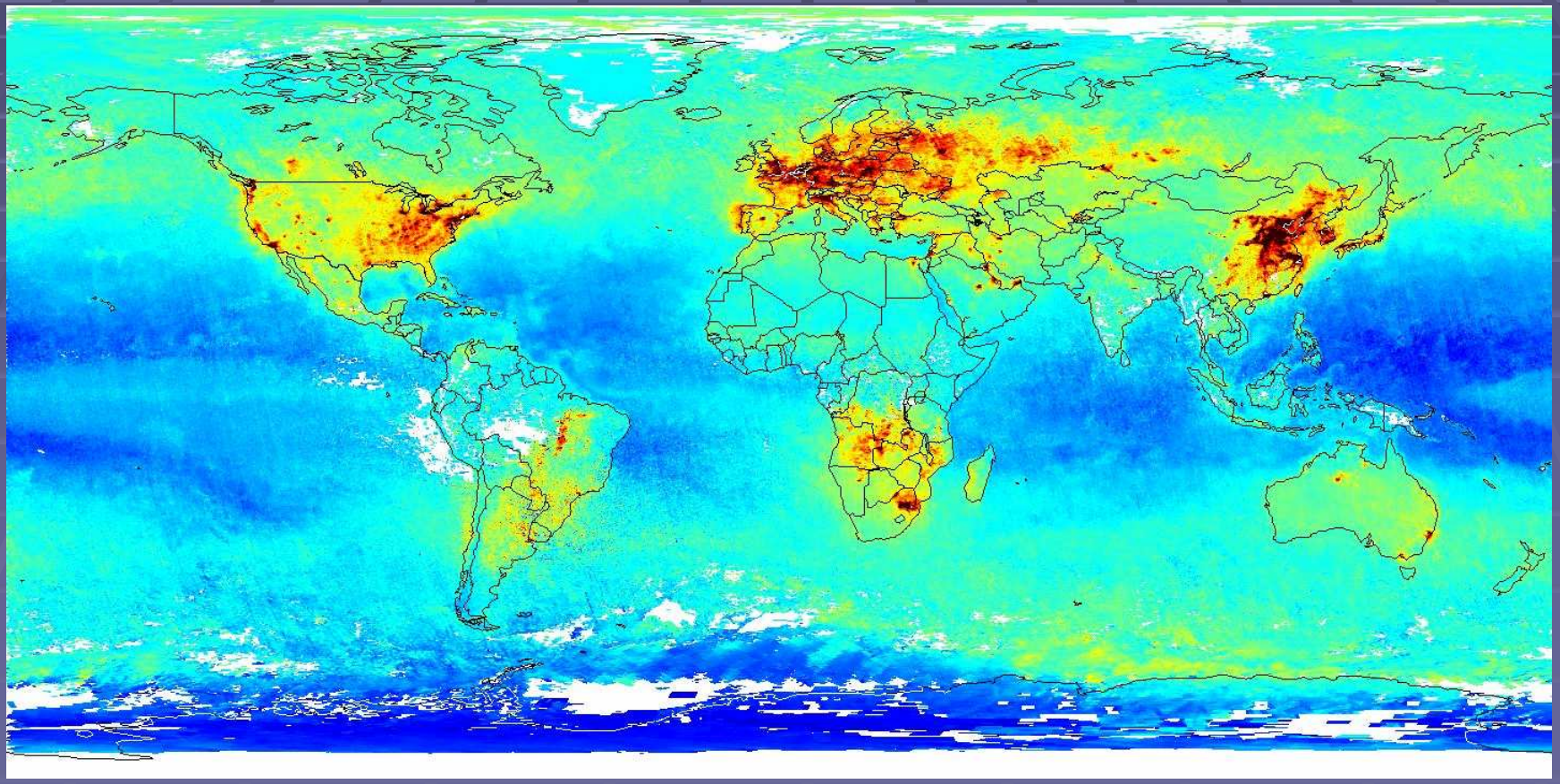
OMI Total NO2 column 2007.10.26

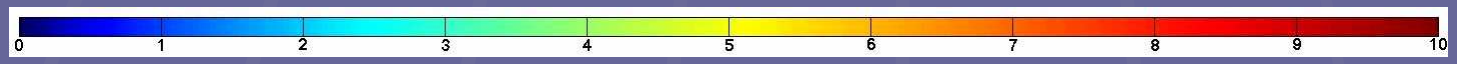


OMI Tropospheric NO2 column 2007.10.26



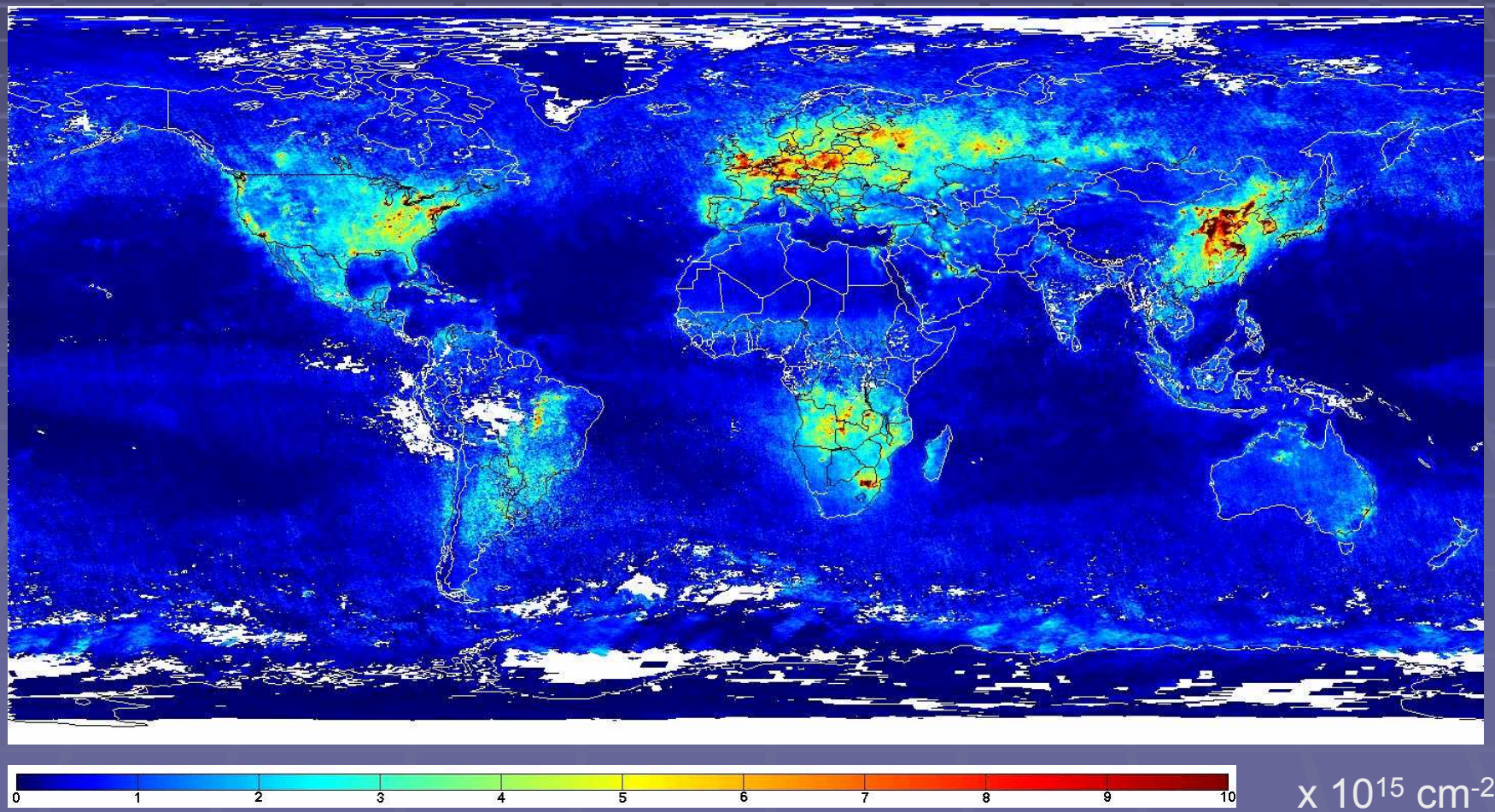
September 2007 Average Total NO_2



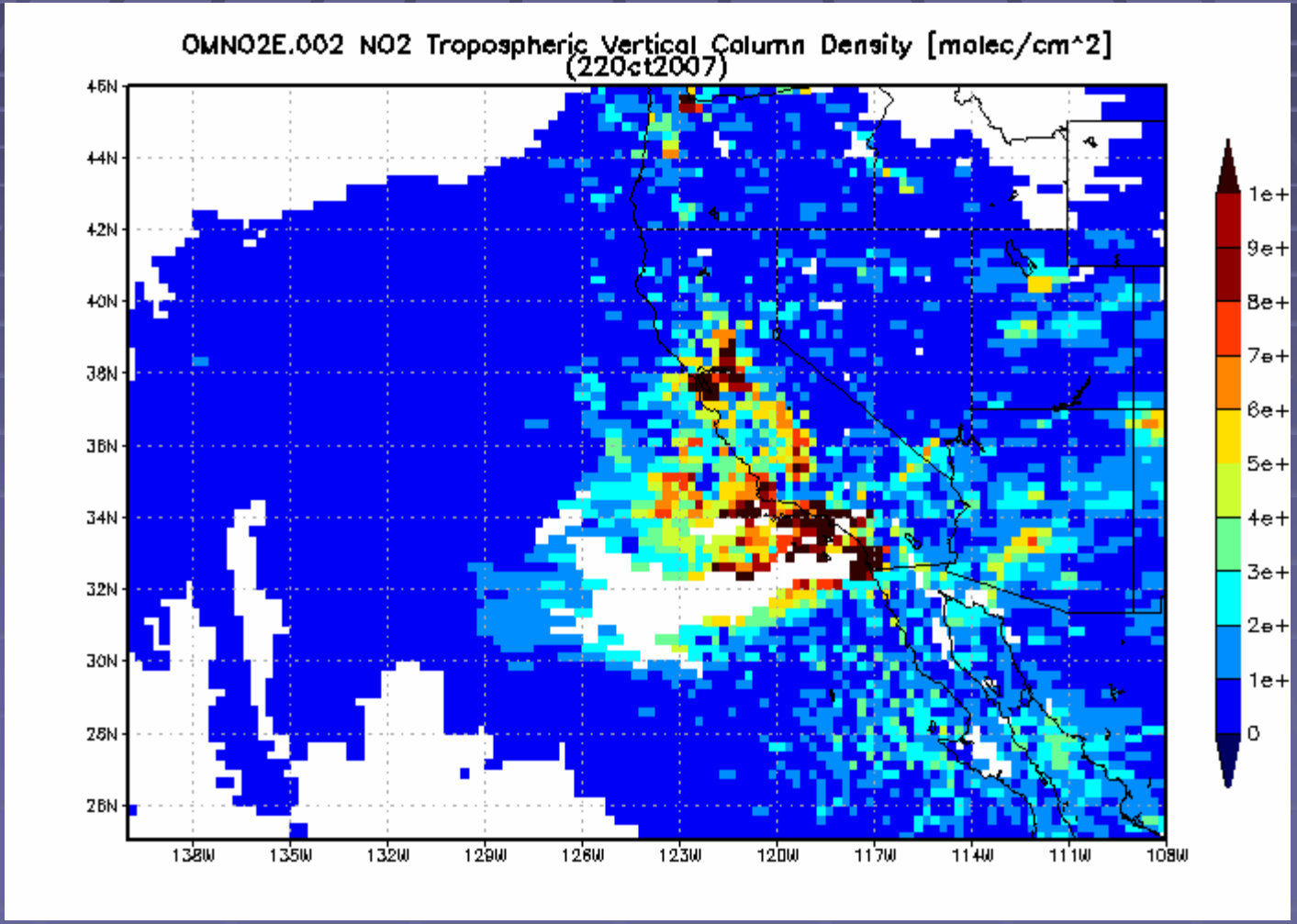


x 10^{15} cm^{-2}

September 2007 Average Tropospheric NO_2



California Wildfires 2007.10.22



Graphic produced by Giovanni, GES-DISC

OMI NO_2 Data Availability

Level-2

- One file per orbit
- HDF-EOS v.5 Swath file format
- Available from GES-DISC

Level-2G (gridded)

- One file per day
- Same data as in corresponding L2 files, but organized geographically.
- HDF-EOS v.5 Grid file format
- Available from GES-DISC, Giovanni

OMI NO_2 Standard Product Data Availability (cont'd)

Level 3

- Tropospheric and total NO2 used to produce daily maps on 0.25° x 0.25° grid.
- Data averaged, and weighted by clouds, etc.
- Available as ASCII, and in Google Maps format (kml).
- Available from AVDC

Station Overpass

- Produced for selected locations.
- Plain ASCII files.
- New locations can be requested
- Available from AVDC

Quality of NO_2 data

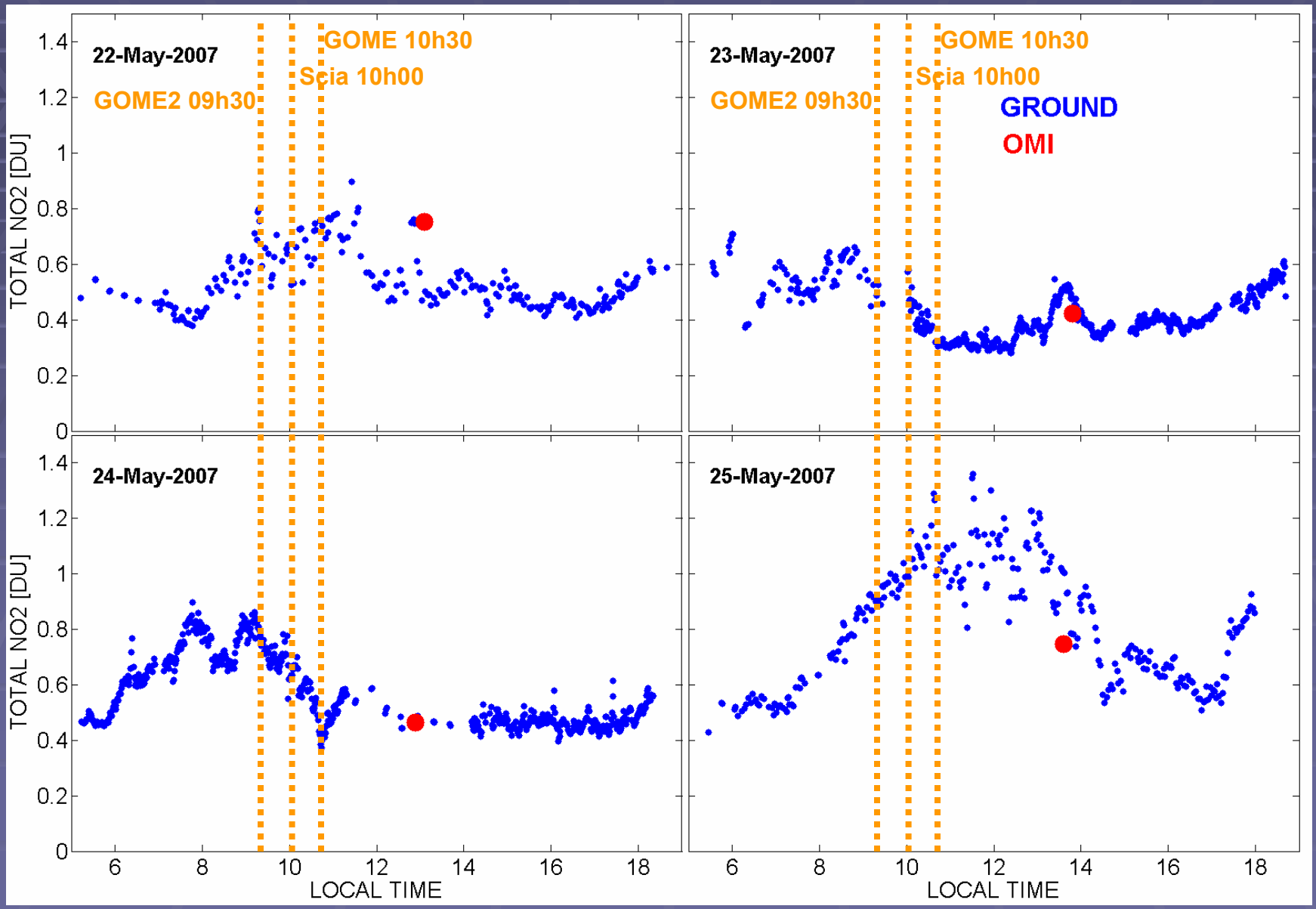
NO2 columns

- Total
- Stratosphere
- Troposphere
- These have been validated in clear-sky conditions against ground based measurements
- OMI (v 1.0) estimates for all three columns tend to be about 15–30% lower than corresponding ground-based estimates.

Cautions about data comparisons

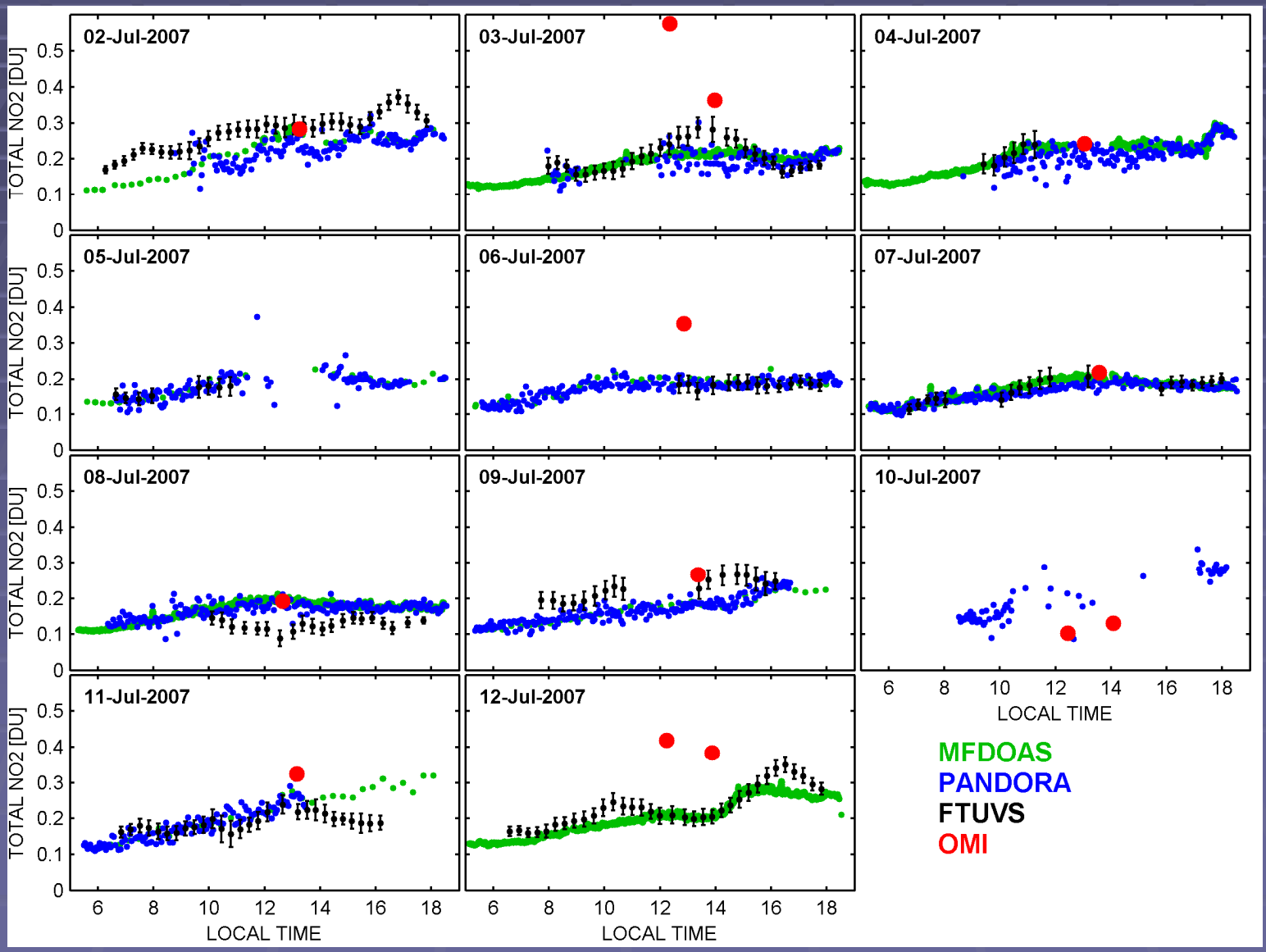
- Time registration
  - Particular problem for comparison with other space borne instruments.

OMI Overpass time



Cautions about data comparisons

- Time registration
- Spatial collocation with ground-based measurements
  - Size of the effect depends on the GB measurement site and its environs.
  - Size of the effect also depends on the FoV size.

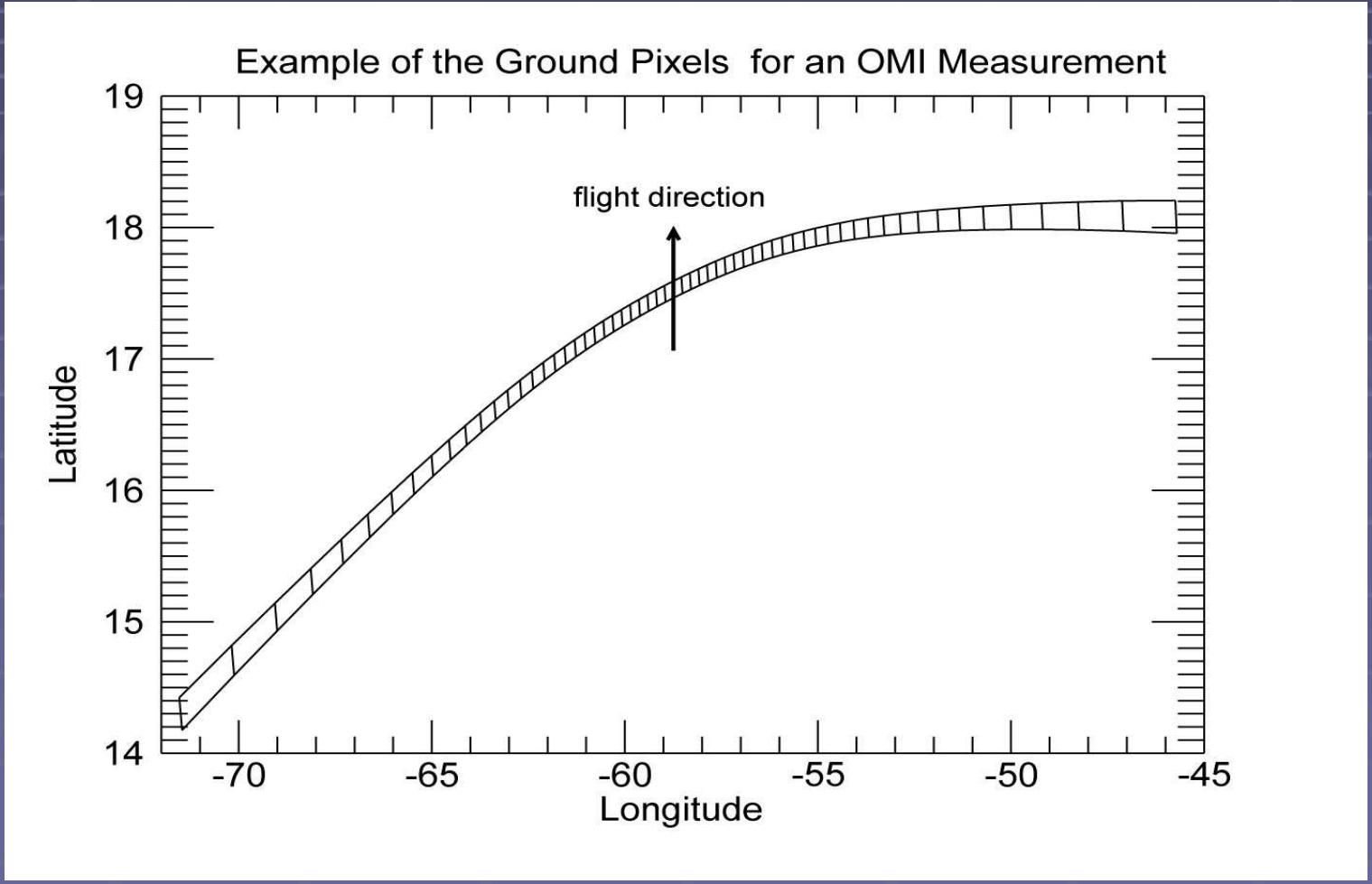

02-Jul-2007
03-Jul-2007
04-Jul-2007
05-Jul-2007
06-Jul-2007
07-Jul-2007
08-Jul-2007
09-Jul-2007
10-Jul-2007
11-Jul-2007
12-Jul-2007
TOTAL NO2 [DU]
0
0.1
0.2
0.3
0.4
0.5
6
8
10
12
14
16
18
LOCAL TIME
MFDOAS
PANDORA
FTUVS
OMI

Victorville
10a(3)
Hesperia
6(12)
11z(23)
4(21)
JPL TM
12b(55)
3b(57)
9(38)
7(47)
10b(58)
12a(0)
8(6)
3a(1)
Pasadena
16.8 mi
Image © 2007 DigitalGlobe
© 2007 Europa Technologies

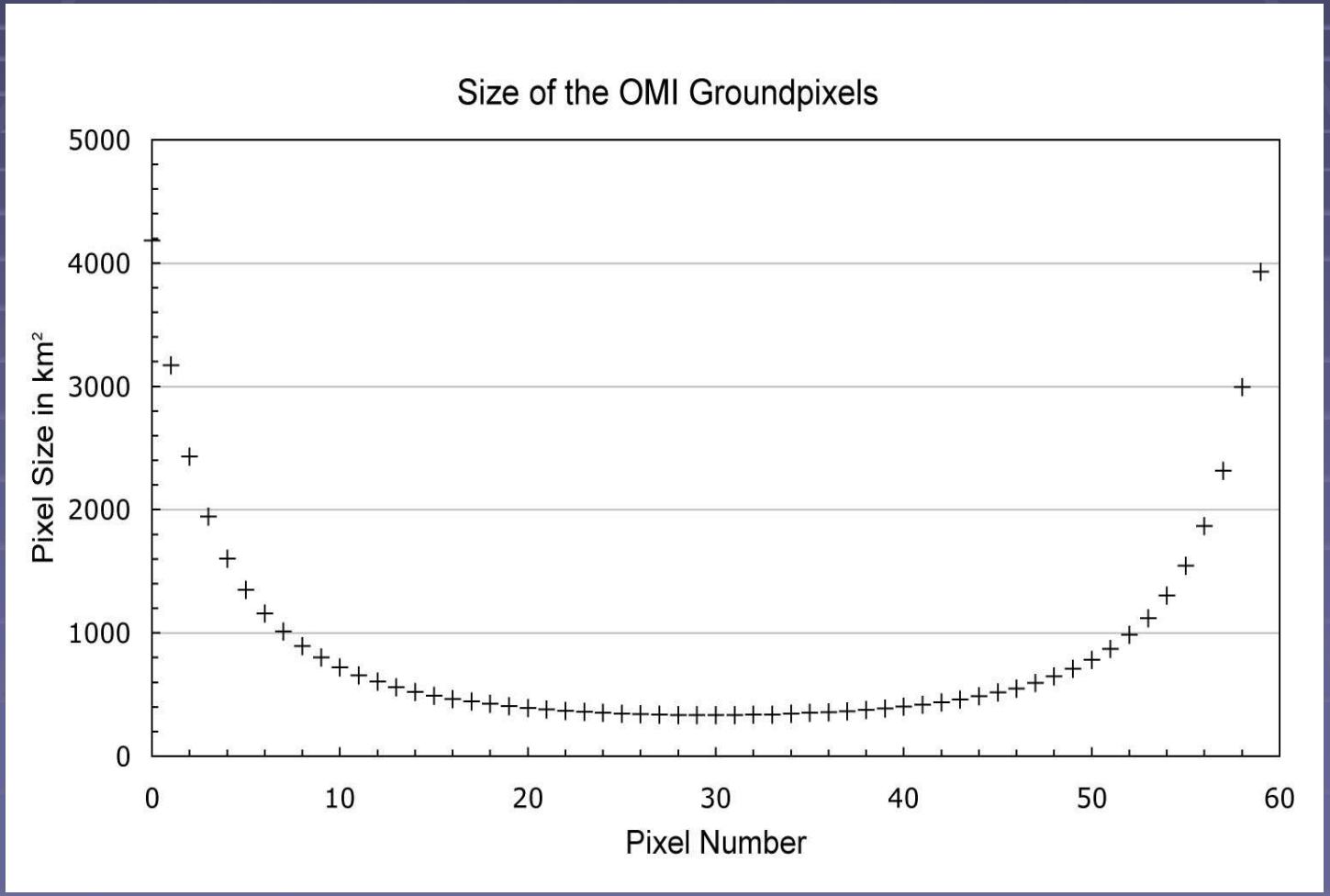
Cautions about data comparisons

- Time registration
- Spatial collocation with ground-based measurements
- Field-of-View size effects
  - Inhomogeneity of the tropospheric field
  - Environment of ground-based instruments
  - Better correlations in rural locations than urban

OMI Field-of-View geometry



OMI Field-of-View geometry



Challenges and work in progress

- Identify sources of possible error in the algorithm.
- Implement improved Level-0 to Level-1 processing.
- Improve ancillary databases (Earth surface reflectivity climatology, a priori profiles)
- Improve uncertainty estimates
- Improve NO_2 estimates with partially clouded scenes
- Validate NO_2 columns in non-clear-sky conditions
- Continue to collect feedback from user community

Contact Information

- For data
  - GES-DISC web site
    - http://disc.gsfc.nasa.gov/
  - AVDC web site
    - http://avdc.gsfc.nasa.gov/
- For Readme File and other technical information
  - GES-DISC and AVDC
- Users of data are encouraged to contact the data product developers for up-to-the-minute technical guidance.